



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of:

Dan S. BLOOMBERG et al.

Application No.: 09/487,583

Filed: January 19, 2000

Docket No.: 104324

For: METHODS FOR GENERATING ANTI-ALIASED TEXT AND LINE GRAPHICS
IN COMPRESSED DOCUMENT IMAGES

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BRIEF ON APPEAL

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Appeal from Group 2623

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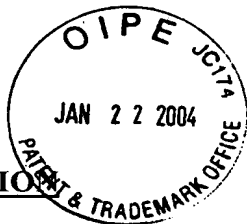
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I. INTRODUCTION

This is an appeal from an Office Action mailed September 8, 2003, finally rejecting claims 1-3, 23, 24, 27, 30, 31, and 39, and objecting to claims 26 and 49-53 of the above-identified patent application. Claim 60 is allowed, and claims 4-22, 28, 29, 40-48, 54-59, and 61-67 are withdrawn from consideration.

A. Real Party In Interest

The real party in interest in the present application is XEROX CORPORATION, by way of an assignment recorded at Reel 010563, Frame 0067.

B. Statement of Related Appeals and Interferences

There are presently no appeals or interferences known to Appellants, Appellants' representative or the Assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

C. Status of Claims

Claims 1-24, 26-31, and 39-67 are pending. Claim 60 is allowed. Claims 4-22, 28, 29, 40-48, 54-59, and 61-67 are withdrawn from consideration.

Claims 1-3, 23, 24, 27, 30, 31, and 39 stand finally rejected and are on appeal. Claim 1 is an independent claim. Claims 2-24 and 26-29 are dependent claims and depend either directly or indirectly from claim 1. Claim 30 is an independent claim. Claims 31 and 39-59 are dependent claims, and depend either directly or indirectly from claim 30. Claim 60 is an independent claim. Claim 61 is an independent claim, and claims 62-67 depend either directly or indirectly from claim 61.

Claims 1-3, 23, 24, 27, 30, 31 and 39, which are all the claims on appeal, stand or fall together.

D. Status of Amendments

The Amendment filed June 19, 2003 is the only Amendment which has been filed. It has been entered. By that Amendment, claims 1, 14, 15, 23, 27, 30, 31, 39-41, 43-45, 47, 49,

50, 52, 53, 55, 56, 58 and 59 were amended, claims 25 and 32-38 were cancelled, and claims 60-67 were added. Claims 2-13, 16-22, 24, 26, 28, 29, 42, 46, 48, 51, 54, and 57 are originally filed claims, which have not been amended.

II. SUMMARY OF THE INVENTION AND APPLIED REFERENCES

A. The Disclosed Invention

The present invention provides a system and method for storing and generating anti-aliased text or lineart from document image files to improve the appearance of rendered text or lineart at both low and high resolutions with minimal cost in additional storage and rendering complexity.

The invention generates an anti-aliased grayscale version of a text or lineart mask used within an ordered set of mask/image pairs. The grayscale data can be stored with either lossless compression or with lossy compression. The invention may also be applied to methods for anti-aliasing compressed representations of color images. To interpolate between the low resolution foreground and background color images, three values, e.g., for red, blue and green color separations, are available for each boundary pixel.

The invention involves either generating or saving pixel values for pixels near the boundaries of the text or lineart mask, and using these values in the rendering process to smooth the visual appearance of the boundaries. If the data is compressed, the compressed representation for the pixels associated with the text or lineart mask and its boundary can be either saved as a set of full page images, or as a set of tokens that typically represent connected components in the foreground image.

The invention provides improved display and print rendering of Mixed Raster Content (MRC) compressed images and means for providing anti-aliased text or lineart data while minimizing costs of additional storage and rendering complexity.

The first exemplary embodiment uses high resolution grayscale scans. The second through fourth embodiments may be implemented with a combination of a high resolution

binary scan and a low resolution grayscale scan. The fifth embodiment uses very high resolution binary scans.

The first through fourth embodiments provide methods that use an explicit or implicit extra MRC mask/image pair for the boundary pixels of the text or lineart mask. Methods according to the fifth embodiment generate the gray boundary pixels at high resolution directly from a very high resolution binary representation of the text or lineart mask.

The second and third exemplary embodiments classify the boundary pixels of each type (ON and OFF) depending on their neighboring pixels in the text or lineart mask image, and substitute a specific pixel value for each type globally. The second exemplary embodiment uses an adaptive algorithm that computes the best pixel values from the image; the other uses pre computed pixel values for similar images. Additional storage for this method is insignificant or nil.

Figure 16 shows a flowchart indicating the flow of a method for providing anti-aliased text and lineart data in accordance with the second exemplary embodiment. The method begins in step S1600 and control proceeds to step S1610. In step S1610, the image is scanned specially to determine the actual grayscale values of the boundary pixels at high resolution. Control then proceeds to step S1620. In step S1620, the grayscale image data is binarized to produce high resolution binary data using a set threshold. Control then proceeds to step S1630. In step S1630, the boundary pixels are identified and control proceeds to step S1640. In step S1640, the boundary pixels are separated into interior and exterior pixels, which are boundary pixels that are ON and OFF, respectively, in the text or lineart mask. Control then proceeds to step S1650, in which each subset, e.g., interior and exterior pixels, is analyzed separately to determine connectedness to determine an appropriate gray value for each of the boundary pixels. Performance of step S1650 is based on the assumption that the grayscale value of the original boundary pixel is correlated with the number of connected pixels in the mask image of opposite (or same) color. Subsequently, control proceeds to step

S1660, gray scale values are calculated for the boundary pixels and control proceeds to step S1670. In step S1670, the high resolution binary boundary pixel values and the derived grayscale values of the grayscale pixel data are stored in memory as compressed data. Control then proceeds to step S1680 in which the high resolution binary boundary pixel data and the derived grayscale values of the boundary pixels are used to render the image and control proceeds to step S1690. In step S1690, the method ends.

Two pixels are 4-connected if their positional relation is such that a second pixel is positioned adjacent to a first pixel to the immediate left, right, top or bottom of the first pixel. Two pixels are 8-connected if their positional relation is such that the second pixel is positioned adjacent to the first pixel to the immediate left, right, top or bottom or to the immediate upper-left, upper-right, lower-left or lower-right of the first pixel. As mentioned above, an assumption is made that the grayscale value of the original boundary pixel is correlated with the number of connected pixels in the mask image of opposite (or same) color. For example, an interior (ON) pixel with three 4-connected OFF pixels is expected to be lighter than one with only one 4-connected OFF pixels. Therefore, each of the boundary pixels of each type is analyzed in the image to form an estimate of its gray value from the connectivity. This estimate is formed by building a histogram of pixel values for each type and for each connectivity, and taking the median pixel value.

Step S1640 may be performed using either type-4 or type-8 connectivity. Experiments have been performed using both type-4 connectivity (analyzing the four orthogonal pixels surrounding a sampled pixel) and type-8 connectivity (analyzing the four orthogonal pixels as well as the four diagonal pixels surrounding the sampled pixel). The differences in results between type-4 and type-8 are not large. However, the type-4 connectivity evaluation results are discussed below in more detail because they are easier to visualize.

To illustrate the validity of the assumption of pixel value correlation with connectivity, Figures 17 and 18 show a plot of histograms for interior and exterior boundary pixels respectively. Fig. 17 shows the histograms of interior boundary pixels, for 0, 1, 2 and 3 four-neighbors of opposite (OFF) color. Figure 18 shows the histograms of exterior boundary pixels, for 0, 1, 2 and 3 four-neighbors of opposite (ON) color.

Four curves can be distinguished in each of Figs. 17 and 18. In Fig. 17, the interior histogram, these curves are for 0, 1, 2, and 3 connected pixels of opposite (OFF) color. There are few cases where four connected pixels are OFF, and during analysis these pixel values are set to the threshold value used for constructing the text or lineart mask. In Fig. 18, the exterior histogram, the four curves are again for 0, 1, 2 and 3 connected pixels of opposite (ON) color. There are few cases with pixels with four ON 4-neighbors. During analysis, these pixel values are also set to threshold value used for constructing the text or lineart mask. In the data shown in Figs. 17 and 18, the threshold value used for constructing the text or lineart mask was 152. As a result, it should be recognized that there are some pixels in each histogram that cross over the threshold that was used to generate the mask. This cross over is merely an artifact of the use of a smoothing filter of length 7 that was applied to the histograms.

The median pixel values are found from the (unsmoothed) histograms, and are shown for interior and exterior boundary pixels in Figures 19 and 20, respectively. In each of these Figures, the median pixel value is plotted against the number of mask neighbors of opposite color.

Figure 21 shows a magnified text fragment that is produced by substituting the mean values shown in Figs. 19 and 20 globally for the boundary pixels. Fig. 21 shows the MRC image with grayscale mask boundary using 4-connected median adapted pixel values. The magnified text fragment shown in Fig. 21 is noisier than the corresponding fragment of the

original image but storing the image data only requires storing the ten median values in addition to the standard MRC data. Figure 22 shows the result of the 4x sub-sampled image.

Figure 23 also shows the magnified text fragment that is produced by substituting the mean values shown in Figs. 19 and 20 globally for the boundary pixels. However, Fig. 23 shows the MRC image with grayscale mask boundary using 8-connected median adapted pixel values. Figure 24 shows the result of the 4x sampled image. Comparison of Fig. 21 and Fig. 23 indicates that there is little apparent difference in image quality between the 4 and 8 connected versions, when viewed on a display.

Each of the exemplary embodiments of the invention assigns gray values to the boundary pixels of the text or lineart mask and provides methods for grayscale anti aliasing that are extended to color images, for text or lineart masks that are compressed either as images or as tokens.

The present invention provides the capability of using a grayscale value for the boundary pixel to render, by interpolation, color pixels when the text or lineart mask is compressed either as a full image or in tokens, and using any of the five exemplary embodiments of the invention.

The system and method allow images to be displayed at both high and low (sub-sampled) resolution, without the defects evident from thresholding and achieve improved rendering.

B. The Claimed Invention

Claim 1 recites an image rendering system comprising (1) a scanner that scans an image and produces image data; (2) an encoder that is coupled to the scanner and encodes the image data to provide encoded image data including anti-aliased grayscale text or lineart data that includes an identification of boundary pixels and associated pixel values, wherein the encoder separates the boundary pixels into interior boundary pixels and exterior boundary pixels; and (3) a decoder that is coupled to the encoder and decodes the encoded image data

to provide decompressed data including anti-aliased text or lineart data and renders the decompressed data.

Claim 30 recites an image rendering method comprising (1) scanning an image to obtain scanned image data including text or lineart data; (2) generating an anti-aliased grayscale version of the text or lineart data including determining pixel values of the boundary pixels in the anti-aliased grayscale version of the scanned text or lineart data; (3) separating the pixels into boundary pixels and non-boundary pixels; and (4) rendering the image using the determined pixel values.

C. The Applied References

1. GB 2 247 586A to Jozefowski

Jozefowski teaches a frame store for holding image data (sub-pixel data) at a resolution higher (Figure 2A) than that required for a display system (Figure 2B). The system of Jozefowski takes data from a frame store, converts it into a form having the lower resolution required by the display system, and in so doing uses the stored sub-pixel data to determine the image data for the relevant display pixels, and outputs this lower resolution data to the display system.

Jozefowski's method for converting high resolution frames into low resolution frames consists of taking a predetermined number of consecutive pixels in the frame buffer, determining a transparency value, i.e., image intensity value, of a single pixel to be displayed on the lower-resolution display device based on a formula taking into account the intensity values of the predetermined number of consecutive pixels, displaying the single pixel value on the low resolution display device, retrieving the next predetermined number of consecutive values in the frame buffer, and repeating this process until all of the pixels in the high resolution frame buffer have been processed to create a low resolution image on the display device.

2. EP 0 590 923 A2 to Smith

Smith is directed to a method for compressing and storing grayscale bitmaps. In Smith, the method includes scanning an image within a first grid of pixels, determining a grayscale value for each pixel scanned in the first grid of pixels, and, for each pixel scanned, activating a number of pixels of a second grid of pixels corresponding to the grayscale value determined. Data representing the second grid of pixels is compressed, and stored for use in facsimile transmission or reprographic image production.

According to another embodiment of Smith, a method includes scanning an image to produce a digital representation of the scanned image at a first resolution with a predetermined number of grayscale values, converting the digital representation of the image to an increased resolution, and having only 2 grayscale values. The converted digital representation is then compressed and stored. Smith thus provides for efficient compression of the less significant bits in grayscale bitmap applications.

D. The Rejection

The final Office Action rejects claims 1-3, 23-24, 27, 30-31, and 39 are unpatentable over U.K. Patent No. GB 2,247,596 A to Jozefowski in view of European Patent No. 0,590,923 to Smith.

III. THE ISSUE ON APPEAL

Whether, under 35 USC §103(a), the Examiner has established that claims 1-3, 23-24, 27, 30-31, and 39 are unpatentable over U.K. Patent No. GB 2,247,596 A to Jozefowski in view of European Patent No. 0,590,923 to Smith.

IV. GROUPING OF CLAIMS

Claims 1-3, 23, 24, 27, 30, 31 and 39, which are all the claims on appeal, stand or fall together.

V. **LAW (35 USC §103(a) (Obviousness))**

The Supreme Court in Graham v. John Deere, 383 U.S. 1 at 18, 148 USPQ 459 at 467 (1966), set forth the basic test for patentability under 35 U.S.C. §103:

Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unresolved need, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter to be patented.

Moreover, in In re Ehrreich and Avery, 200 USPQ 504, 509-510 (CCPA 1979), the Court of Customs and Patent Appeals further clarified the basic test set forth in Graham v. John Deere:

We must not here consider a reference in a vacuum, but against the background of the other references of record which may disprove theories and speculations in the reference or reveal previously undiscovered or unappreciated problems. The question in a §103 case is what the references would collectively suggest to one of ordinary skill in the art. In re Simon, 461 F.2d 1387, 174 USPQ 114 (CCPA 1972). It is only by proceeding in this manner that we may fairly determine the scope and content of the prior art according to the mandate of Graham v. Deere Company, 383 US 1, 17, 148 USPQ 459, 467 (1966). (Emphasis in original.)

Thus, the mere fact that parts of prior art disclosures can be combined does not make the combination obvious unless the prior art also contains something to suggest the desirability of the combination. In re Imperato, 486 F.2d 585 (CCPA 1973).

To imbue one of ordinary skill in the art with knowledge of the invention, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of hindsight syndrome wherein that which only the inventor taught is used against its teacher. W.L. Gore & Assoc. v. Garlock, Inc., 721 F.2d 1540, 1533, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Further, analyzing the claimed invention as a whole in view of the prior art as a whole, one indicium of nonobviousness is a "teaching away" from the claimed invention by

the prior art at the time the invention was made. See U.S. v. Adams, 148 USPQ 479 (1966). Essentially, teaching away from a claimed invention is a per se demonstration of lack of prima facie obviousness.

Where the prior art provides "only general guidance and is not specific as to the particular form of the invention or how to achieve it, [such a suggestion] may make an approach 'obvious to try,' but it does not make the invention obvious." Ex parte Obukowicz, 27 USPQ2d, 1063, 1065 (U.S. Patent and Trademark Office Board of Appeals and Interferences, 1992) and In re O'Farrell, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988).

Further, in In re Wright, 848 F.2d 1216, 6 USPQ2d 1959 (Fed. Cir. 1988), the Federal Circuit stated:

Factors including unexpected results, new features, solution of a different problem, novel properties are all considerations in the determination of obviousness...

These secondary considerations (objective evidence of non-obviousness) as outlined in Graham v. John Deere and further characterized in In re Wright must be evaluated before reaching an ultimate decision under 35 U.S.C. §103.

The test for obviousness is what the combined teachings would have suggested to one of ordinary skill in the art. See, In re Young, 927 F.2d 588, 591, 18 USPQ2d 1989, 1091 (Fed. Cir. 1991) and In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). More specifically, as stated by the court in Keller, 642 F.2d at 425, 208 USPQ at 881, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary references; nor is it that the claimed invention must be expressly suggested in one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. Moreover, the artisan is not compelled to blindly adopt every single aspect of the teachings of any one reference without the exercise of independent judgment, see Lear Siegler, Inc. v. Aeroquip Corp., 733 F.2d 881, 889, 221 USPQ 1025, 1032 (Fed. Cir. 1984).

With regard to motivation to combine the references used in the rejection of appellant's claims, while there must be some teaching, reason, suggestion or motivation to combine existing elements to produce the claimed device, it is not necessary that the cited references or prior art specifically suggest making the combination. See, B.F. Goodrich Co. v. Aircraft Braking Systems Corp., 72 F.3d 1577, 1583, 37 USPQ2d 1314, 1319 (Fed. Cir. 1996) and In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988). Rather, the test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art.

The Office Action must provide proper motivation to combine the teaching of different references. The first requirement of proper motivation is that a showing of a suggestion, teaching, or motivation to combine the prior art references is an “essential evidentiary component of an obviousness holding.” C.R. Bard, Inc. v. M3 Sys. Inc., 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998). This evidence may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved. See Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996). However, the suggestion more often comes from the teachings of the pertinent references. See In re Rouffet, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998). This showing must be clear and particular, and broad conclusory statements about the teaching of multiple references, standing alone, are not “evidence.” See Dembiczak, 175 F.3d at 1000, 50 USPQ2d at 1617.

The Office Action must also demonstrate that modifying one reference in view of another reference is even feasible. Moreover, the case law requires that for motivation to be proper, showing that something is feasible is not enough. Just because something is feasible does not mean that it is desirable or that one of ordinary skill in the art would be motivated to do what is feasible. See Winner International Royalty Corp. v. Wang, 53 USPQ2d 1580

(Fed. Cir. 2000) which points out that motivation to combine references requires a showing not just of feasibility, but also of desirability.

In Tec Air Inc. v. Denso Manufacturing Michigan Inc., 52 USPQ2d 1294 (Fed. Cir. 1999), the Court of Appeals for the Federal Circuit stated that there is no suggestion to combine relevant teachings from different references if a reference teaches away from its combination with another source. The court also stated that a reference may be said to teach away when a person of ordinary skill in the art, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.

Additionally, in In re Braat, 16 USPQ2d 1812 (Fed. Cir. 1990) (unpublished), the Court of Appeals for the Federal Circuit reversed a decision by the PTO Board of Appeals and Interferences, stating that the reference upon which the obviousness of claim 1 was based taught away from the claimed invention, and that "[O]ne important indicium of non-obviousness is "teaching away" from the claimed invention by the prior art," citing In re Dow Chemical Co., 5 USPQ2d 1529, 1532 (Fed. Cir., 1988).

Moreover, a factual inquiry whether to modify a reference must be based on objective evidence of record, not merely conclusionary statements of the Examiner. See, In re Lee, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

VI. ARGUMENT

A. Claims 1-3, 23-24, 27, 30-31, and 39 are not taught or suggested by the Jozefowski/Smith combination

Claims 1-3, 23-24, 27, 30-31, and 39 stand rejected under 35 USC §103(a) as unpatentable over U.K. Patent No. GB 2,247,596 A to Jozefowski in view of European Patent No. 0,590,923 to Smith.

Independent claim 1 recites, inter alia, an encoder that is coupled to the scanner and encodes the image data to provide encoded image data including anti-aliased grayscale text or lineart data that includes an identification of boundary pixels and associated pixel values,

wherein the encoder separates the boundary pixels into interior boundary pixels and exterior boundary pixels.

Independent claim 30 recites, inter alia, generating an anti-aliased grayscale version of the text or lineart data including determining pixel values of the boundary pixels in the anti-aliased grayscale version of the scanned text or lineart data; (3) separating the pixels into boundary pixels and non-boundary pixels.

Jozefowski fails to disclose or suggest these positively recited features.

The final Office Action asserts that these features of claims 1 and 30 are disclosed by Jozefowski -see pages 6-8 of the final rejection. However, in the first full paragraph of page 5 of the final Office Action, what is stated is significantly different. On page 5, first full paragraph, the final Office Action states that "Jozefowski clearly teaches a similar anti-aliasing system to that of applicant" (emphasis added).

Applicants respectfully submit that the standard for whether a reference discloses a claimed feature that the reference allegedly discloses is not that the reference teaches something "similar."

Either the reference teaches what is claimed or it does not teach what is claimed.

Thus, the final Office Action is inconsistent. The final rejection itself says that Jozefowski discloses that "the encoder separate[s] the boundary pixels into interior boundary pixels and exterior boundary pixels (Figs. 2b, 2c, page 10-11;" whereas the response to arguments section of the final Office Action tacitly admits that this is not true in the sense that what Jozefowski discloses is something different than what is claimed.

Because the final Office Action is inconsistent in this fundamental aspect, it is improper and should be reversed.

Turning to the merits of the rejection, Applicants respectfully submit that the assertion that the claimed features of the encoder separating the boundary pixels into interior boundary

pixels and exterior boundary pixels is shown in Figs. 2b, 2C and pages 10 and 11, is incorrect.

A word search of Jozefowski reveals that the reference fails to explicitly discuss "interior" and/or "exterior" pixels. The concept of "interior" pixels and/or "exterior" pixels is totally missing from Jozefowski.

Because the final rejection is based on the incorrect premise that Jozefowski discloses interior pixels and exterior pixels, it is fundamentally unsound and should be reversed.

The final Office Action also states, in the first full paragraph on page 5 of the final Office Action that the Jozefowski can identify/separate interior/exterior boundary pixels in one dimensional array pixels because it "is well known in the art to separate boundary pixels and non-boundary pixels by setting the pixels for different status/classification. Once the setting is done, one can easily separate the pixels in one direction, either horizontal or vertical."

In the first place, Applicants respectfully submit that there is no objective evidence of what is allegedly well known, as required by In re Lee, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

In the second place, what can possibly be done by Jozefowski does not address what a Jozefowski actually discloses, and bases the rejection on improper speculation and hindsight.

The final rejection simply fails to apply any reference that discloses the positively recited feature of separating the boundary pixels into interior boundary pixels and exterior boundary pixels.

The closest that Jozefowski comes to the claimed invention is the disclosure of "boundary pixels." Jozefowski defines "boundary pixels" on page 18, with respect to Fig. 1B, as "the blocks near the real line." Applicants can find no other definition of boundary pixels in Jozefowski. This definition is given only in the context of a line. There is absolutely no mention or definition of "interior" pixels or "exterior" pixels is found in

Jozefowski. Also, no disclosure of separating interior and exterior pixels is found in Jozefowski.

Furthermore, Jozefowski's disclosed pixel classification scheme is dramatically different from what is claimed. As pointed out by Jozefowski on page 17, "[W]herever the real line 11 crosses or touches a block, that block is lit (shown dark in the figure." This is true in Fig. 2A as well. As pointed out in the first full paragraph on page 20, Jozefowski states that " Just as in Figure 1A, the Figure 2A line 11 "lights" the sub-pixels (as 23) it actually passes through. . ." Jozefowski goes on to state that "Figure 2B shows the same line as actually seen on a 1 block per centimeter display, with anti-aliasing according to the invention." The rest of the first full paragraph on page 20, which explains Jozefowski's invention, is totally devoid of any disclosure of separating the pixels into boundary pixels and non-boundary pixels, as recited. Instead, Jozefowski merely indicates that the sub-pixel data in the frame store is used to calculate the "transparency" of each display pixel.

Jozefowski is directed to reducing an antialiasing technique to a straight line and does not disclose, nor concern, establishing and/or separating boundary pixels into interior boundary pixels and exterior boundary pixels.

Accordingly, Jozefowski, the principal reference on which the claims are rejected, does not disclose or suggest the aforementioned positively recited features of the claimed invention.

The final Office Action applies a secondary reference to Smith only for the purpose of disclosing a scanner that scans an image and produces image data (Fig. 5, element 50) and also encoding anti-aliased text.

In other words, Smith is not applied to remedy the aforementioned shortcomings defects in Jozefowski which are pointed out above, including, separating boundary pixels into interior boundary pixels and exterior boundary pixels. Accordingly, even if Smith were

properly combined with Jozefowski , the resulting reference combination would not render obvious the claimed invention.

Claims 2, 3, 23, 24 and 27 depend from claim 1 and are patentable over Jozefowski at least for the aforementioned reasons that claim 1 is patentable. Claims 31 and 39 depend from claim 30 and are patentable over Jozefowski at least for the aforementioned reasons that claim 1 is patentable.

Accordingly, the rejection of claims 1-3, 23, 24, 27,30, 31 and 39 under 35 USC §103(a) as unpatentable over Jozefowski in view of Smith is improper and should be reversed.

VII. CONCLUSION

The applied references, Jozefowski and Smith, fail to disclose or render obvious all the features of claims 1-3, 23-24, 27, 30-31, and 39 under 35 U.S.C. §103(a). Thus, claims 1-3, 23-24, 27, 30-31, and 39 are patentable over the applied references.

The Honorable Board is requested to reverse the rejection set forth in the Final Rejection and to return the application to the Examiner to pass the application to issue.

Respectfully submitted,


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Enclosure:

Appendix of Claims

Date: January 22, 2004

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| |
|--|
| <p>DEPOSIT ACCOUNT USE AUTHORIZATION Please grant any extension necessary for entry; Charge any fee due to our Deposit Account No. 24-0037</p> |
|--|



APPENDIX A

CLAIMS:

1. (Previously Presented) An image rendering system comprising:
a scanner that scans an image and produces image data;
an encoder that is coupled to the scanner and encodes the image data to provide encoded image data including anti-aliased grayscale text or lineart data that includes an identification of boundary pixels and associated pixel values, wherein the encoder separates the boundary pixels into interior boundary pixels and exterior boundary pixels; and
a decoder that is coupled to the encoder and decodes the encoded image data to provide decompressed data including anti-aliased text or lineart data and renders the decompressed data.
2. (Original) The image rendering system of claim 1, wherein the system implements an MRC image architecture.
3. (Original) The image rendering system of claim 1, further comprising memory that is coupled to the encoder and decoder and that stores the encoded image data, the memory being coupled to the decoder.
4. (Original) The image rendering system of claim 1, wherein the scanner scans an image and produces high resolution grayscale data, and wherein the encoder separates the grayscale pixels of the high resolution grayscale data into boundary pixels and non-boundary pixels, individually derives values of grayscale boundary pixels using the high resolution grayscale data, and stores the individually derived values of the grayscale boundary pixels.
5. (Original) The image rendering system of claim 4, wherein the encoder compresses the individually derived values of the grayscale boundary pixels as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

6. (Original) The image rendering system of claim 5, wherein the image data is color image data and a foreground image and a background image of the scanned image data are represented by low-resolution color data.

7. (Original) The image rendering system of claim 5, wherein, during compression, the encoder selects the boundary pixels from the scanned image data, quantizes the boundary pixels and analyzes each token as both a foreground layer and a boundary layer.

8. (Original) The image rendering system of claim 7, wherein the foreground layer and the boundary layer are compressed separately.

9. (Original) The image rendering system of claim 5, wherein only one set of boundary pixels is stored for each token.

10. (Original) The image rendering system of claim 6, wherein, for each high resolution color boundary pixel on a token, three colors are stored as three grayscale values.

11. (Original) The image rendering system of claim 10, wherein each grayscale value is computed as a fraction of an intensity between the foreground image and the background image.

12. (Original) The image rendering system of claim 10, wherein grayscale values of the boundary pixels are used to interpolate between foreground and background images during rendering of the image data.

13. (Original) The image rendering system of claim 12, wherein the three grayscale values are used for interpolation between foreground and background pixels on the boundary pixels of each instance of the token.

14. (Previously Presented) The image rendering system of claim 4, wherein the scanner stores the individually derived values of the grayscale boundary pixels by storing at least a full image mask corresponding to the scanned image data.

15. (Previously Presented) The image rendering system of claim 1, wherein the scanner scans the image and produces high resolution grayscale data and the encoder separates the grayscale pixels of the high resolution grayscale data into boundary pixels and non-boundary pixels, determines boundary pixel connectedness for both the interior boundary pixels and the exterior boundary pixels, determines a representative grayscale value for the interior boundary pixels and a representative grayscale value for the exterior boundary pixels based on the connectedness of the interior boundary pixels and the exterior boundary pixels respectively and stores the grayscale values for the boundary pixels.

16. (Original) The image rendering system of claim 15, wherein the encoder stores the individually derived values of the grayscale boundary pixels by compressing the individually derived values of the grayscale boundary pixels as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

17. (Original) The image rendering system of claim 1, wherein the scanner scans the image and produces high resolution binary data and the encoder individually estimates median boundary pixel values based on a number of oppositely colored four neighbor pixels to each of the boundary pixels and stores the estimated median boundary pixel values.

18. (Original) The image rendering system of claim 17, wherein the encoder stores the estimated median boundary pixel values by compressing the estimated median boundary pixel values as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

19. (Original) The image rendering system of claim 18, wherein the decoder performs rendering of the grayscale tokens by analyzing a connectivity of the boundary pixels and performing grayscale substitutions.

20. (Original) The image rendering system of claim 19, wherein substitution values used during performing grayscale substitutions are known a priori.

21. (Original) The image rendering system of claim 17, wherein the encoder stores the estimated median boundary pixel values by compressing the estimated median boundary pixel values as part of a foreground mask that represents connected components in a foreground image that is part of the scanned image data.

22. (Original) The image rendering system of claim 21, wherein the decoder performs rendering of the foreground mask by analyzing a connectivity of the boundary pixels and performing grayscale substitutions.

23. (Previously Presented) The image rendering system of claim 1, wherein the scanner scans the image and produces high resolution binary data.

24. (Original) The image rendering system of claim 23, wherein the encoder determines a first global grayscale value corresponding to the interior boundary pixels and a second global grayscale value corresponding to the exterior boundary pixels and stores the interior and exterior boundary pixel data including the first and second grayscale boundary pixel values.

25. (Cancelled)

26. (Original) The image rendering system of claim 24, wherein the first and second default global values are determined based on analysis of image data other than the scanned image data.

27. (Previously Presented) The image rendering system of claim 23, wherein the decoder renders the image using the interior and exterior boundary pixel values and the high resolution binary data.

28. (Original) The image rendering system of claim 1, wherein the scanner scans the image and produces very high resolution binary data and the encoder converts the very

high resolution binary data to high resolution grayscale data and stores the high resolution grayscale data.

29. (Original) The image rendering system of claim 28, wherein the encoder stores the high resolution grayscale data by compressing the high resolution grayscale data as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

30. (Previously Presented) An image rendering method comprising:
scanning an image to obtain scanned image data including text or lineart data;
generating an anti-aliased grayscale version of the text or lineart data
including determining pixel values of the boundary pixels in the anti-aliased grayscale version of the scanned text or lineart data;
separating the pixels into boundary pixels and non-boundary pixels;
rendering the image using the determined pixel values.

31. (Previously Presented) The image rendering method of claim 30, wherein:
scanning the image comprises producing high resolution grayscale data; and
generating the anti-aliased grayscale version of the text or lineart data further comprises:

individually deriving values of grayscale boundary pixels using the high resolution grayscale data, and

storing the individually derived values of the grayscale boundary pixels.

32. (Cancelled)

33. (Cancelled)

34. (Cancelled)

35. (Cancelled)

36. (Cancelled)

37. (Cancelled)

38. (Cancelled)

39. (Previously Presented) The image rendering method of claim 31, wherein storing the individually derived values of the grayscale boundary pixels includes storing a full image mask corresponding to the scanned image data.

40. (Previously Presented) The image rendering method of claim 30, wherein:
scanning the image comprises producing high resolution grayscale data; and
generating the anti-aliased grayscale version of the text or lineart data

comprises:

separating the grayscale boundary pixels into interior boundary pixels
and exterior boundary pixels,

determining grayscale boundary pixel connectedness by separately
analyzing the interior grayscale boundary pixels and the exterior grayscale boundary pixels,

individually deriving values of grayscale boundary pixels using the
high resolution grayscale data and the determined grayscale boundary pixel connectedness,
and

storing the individually derived values of the grayscale boundary
pixels.

41. (Previously Presented) The image rendering method of claim 40, wherein storing the individually derived values of the grayscale boundary pixels includes compressing the individually derived values of the grayscale boundary pixels as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

42. (Original) The image rendering method of claim 41, wherein at least one of a token index, location, color, character and font ID and anti-aliasing information are stored with each token instance.

43. (Previously Presented) The image rendering method of claim 41, wherein rendering is performed by rendering grayscale tokens by analyzing a connectivity of the boundary pixels and performing grayscale substitutions.

44. (Previously Presented) The image rendering method of claim 30, wherein scanning the image comprises producing high resolution binary data; and

generating the anti-aliased grayscale version of the text or lineart data comprises:

individually estimating median boundary pixel values based on a number of oppositely colored four neighbor pixels to each of the boundary pixels, and

storing the estimated median boundary pixel values.

45. (Previously Presented) The image rendering method of claim 44, wherein ~~the step of~~ storing the estimated median boundary pixel values comprises storing the estimated median boundary pixel values as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

46. (Original) The image rendering method of claim 45, wherein at least one of a token index, location, color, character and font ID and anti-aliasing information are stored with each token instance.

47. (Previously Presented) The image rendering method of claim 45, wherein rendering is performed by rendering the grayscale tokens by analyzing a connectivity of the boundary pixels and performing grayscale substitutions.

48. (Original) The image rendering method of claim 47, wherein substitution values used during performing grayscale substitutions are known a priori.

49. (Previously Presented) The image rendering method of claim 30, wherein scanning the image comprises producing high resolution binary data; and
generating the anti-aliased grayscale version of the text or lineart data comprises:
separating the boundary pixels into interior boundary pixels and exterior boundary pixels,
determining a first global grayscale value corresponding to the interior boundary pixels and a second global grayscale value corresponding to the exterior boundary pixels, and
storing the interior and exterior boundary pixel data including the first and second grayscale boundary pixel values.

50. (Previously Presented) The image rendering method of claim 49, wherein storing the interior and exterior boundary pixel data comprises storing the interior and exterior boundary pixel data as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

51. (Original) The image rendering method of claim 50, wherein at least one of a token index, location, color, character and font ID and anti-aliasing information are stored with each token instance.

52. (Previously Presented) The image rendering method of claim 49, further comprising storing default global grayscale values including first and second default global grayscale values and setting the interior boundary pixels to the first default global grayscale value and setting the exterior boundary pixels to the second default global grayscale value.

53. (Previously Presented) The image rendering method of claim 52, wherein the first and second default global values are determined based on analysis of image data other than the scanned image data.

54. (Original) The image rendering method of claim 49, further comprising rendering the image using the interior and exterior boundary pixel values and the binary high resolution data.

55. (Previously Presented) The image rendering method of claim 30, wherein scanning the image comprises producing very high resolution binary data; and generating the anti-aliased grayscale version of the text or lineart data comprises:

converting the very high resolution binary data to high resolution grayscale data, and

storing the high resolution grayscale data.

56. (Previously Presented) The image rendering method of claim 55, wherein storing the high resolution grayscale data includes compressing the high resolution grayscale data as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data.

57. (Original) The image rendering method of claim 56, wherein at least one of a token index, location, color, character and font ID and anti-aliasing information are stored with each token instance.

58. (Previously Presented) The image rendering method of claim 55, wherein converting the very high resolution binary data comprises filtering and down sampling the very high resolution binary text or lineart data to produce the high resolution grayscale text or lineart data.

59. (Previously Presented) The image rendering method of claim 58, wherein filtering and down sampling comprises tiling the very high resolution binary text or lineart data prior to subsampling the very high resolution binary text or lineart data, and calculating a gray value for each tile that is proportional to the number of pixels of a first value in the tile.

60. (Previously Added) An image rendering system comprising:

a scanner that scans an image and produces image data and high resolution binary data;

an encoder that is coupled to the scanner and encodes the image data to provide encoded image data including anti-aliased grayscale text or lineart data that includes an identification of boundary pixels and associated pixel values, wherein the encoder separates the boundary pixels into interior boundary pixels and exterior boundary pixels; and

a decoder that is coupled to the encoder and decodes the encoded image data to provide decompressed data including anti-aliased text or lineart data and renders the decompressed data, wherein the decoder stores default global grayscale values including first and second default global grayscale values and sets the interior boundary pixels to the first default global grayscale value and sets the exterior boundary pixels to the second global default grayscale value.

61. (Previously Added) An image rendering method comprising:

scanning an image to obtain scanned image data including text or lineart data, wherein scanning the image produces high resolution grayscale data;

generating an anti-aliased grayscale version of the text or lineart data, comprising:

separating the grayscale pixels of the high resolution grayscale data into boundary pixels and non-boundary pixels,

individually deriving values of grayscale boundary pixels using the high resolution grayscale data, and

storing the individually derived values of the grayscale boundary pixels, including compressing the individually derived values of the grayscale boundary

pixels as part of a set of grayscale tokens that represent connected components in a foreground image that is part of the scanned image data; and

rendering the image using the individually derived pixel values.

62. (Previously Added) The image rendering method of claim 61, wherein storing the individually derived values of the grayscale boundary pixels further comprises:

storing at least one of a token index, location, color, character, font ID, and anti-aliasing information with each token instance.

63. (Previously Added) The image rendering method of claim 61, further comprising:

scanning an image to obtain scanned color image data; and

representing a foreground image and a background image of the scanned color image data by low-resolution color data.

64. (Previously Added) The image rendering method of claim 63, further comprising:

storing three colors as three grayscale values for each high resolution color boundary pixel on a token.

65. (Previously Added) The image rendering method of claim 64, further comprising:

determining each grayscale value as a fraction of an intensity between the foreground image and the background image.

66. (Previously Added) The image rendering method of claim 64, wherein rendering the image further comprises:

interpolating between foreground and background images using grayscale values of the boundary pixels.

67. (Previously Added) The image rendering method of claim 64, further comprising:

interpolating between foreground and background pixels on the boundary pixels of each instance of each token using the three grayscale values.